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ARS 860 (2012) (English): Fortified wheat flour -- Specification



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Fortified wheat flour — Specification

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Foreword

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This African Standard was prepared by the ARSO Technical Harmonization Committee on Agriculture and Food Products (ARSO/THC 1).

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Introduction

Wheat is the most widely produced cereal in the world, most of which is destined for human consumption. The processing of whole wheat to wheat flour is generally concentrated in a few large mills. The resulting flour is used to make bread, biscuits, pasta, and other products. Because of its widespread geographic distribution, acceptance, stability, and versatility, wheat flour is a suitable vehicle for delivering micronutrients to mankind.

In its natural state, wheat is a good source of vitamins B1 (thiamine), B2 (riboflavin), niacin, B6 (pyridoxine), E, as well as iron, and zinc. Nevertheless, because most of these nutrients are concentrated in the outer layers of the wheat grain, a significant proportion is lost during the milling process. For lower extraction rates of flour (i.e. more refined flour), the loss of vitamins and minerals is greater.

In developed countries, wheat flour is generally fortified with vitamins B1, B2, niacin, and iron. In some countries calcium and folate are also added. Vitamins A and D can also be added to flour. The levels of vitamin B1, niacin, and iron added to wheat flour is often equivalent to the amount lost in milling, i.e. these micronutrients are restored and the flour is *enriched*. For other micronutrients such as vitamin B2, the amount added is over and above that lost in milling, i.e. the flour is *fortified*.

Fortification rather than enrichment is done when the overall diet is deficient in particular micronutrients and restoring the micronutrients lost in milling will not make good this deficit.

Compulsory fortification of flour is increasing throughout the world. Currently a number of countries have legislation or regulations that mandate wheat flour be fortified with various micronutrients. Other countries are considering this option. The low cost, and simplicity of the technology has made it one of the most sought after methods for combating micronutrient malnutrition.

This African Standard seeks to establish a uniform regime for fortification which, if adopted, would make it possible to trade in fortified wheat flour across the borders of the countries in the continent.

Fortified wheat flour — Specification

1 Scope

This African Standard specifies the requirements and methods of sampling and test for fortified wheat flour prepared from common wheat (*Triticum aestivum L.*), club wheat (*T. compactum Host.*) or a mixture thereof intended for human consumption.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

CAC/GL 1, *General guidelines on claims*

CAC/GL 2, *Guidelines on nutrition labelling*

CAC/GL 21, *Principles for the establishment and application of microbiological criteria for foods*

CAC/GL 23, *Guidelines for use of nutrition and health claims*

ARS 53, *General principles of food hygiene — Code of practice*

ARS 56, *Prepackaged foods — Labelling*

CODEX STAN 192, *General standard for food additives*

CODEX STAN 193, *Codex general standard for contaminants and toxins in food and feed*

ARS 465, *Wheat — Specification*

ARS 471, *Food grade salt — Specification*

ISO 711, *Cereals and cereal products — Determination of moisture content (Basic reference method)*

ISO 712, *Cereals and cereal products — Determination of moisture content — Reference method*

ISO 2171, *Cereals, pulses and by-products — Determination of ash yield by incineration*

ISO 5498, *Agricultural food products — Determination crude fibre content-General method*

ISO 6579, *Microbiology of food and animal feeding stuffs — Horizontal method for the detection of *Salmonella* spp.*

ISO 7251, *Microbiology of food and animal feeding stuffs — Horizontal method for the detection and enumeration of presumptive *Escherichia coli* — Most probable number technique*

ISO 13690, *Cereals, pulses and milled products — Sampling of static batches*

ISO 16050, *Foodstuffs — Determination of aflatoxin B1, and the total content of aflatoxins B1, B2, G1 and G2 in cereals, nuts and derived products — High-performance liquid chromatographic method*

ISO 20483, *Cereals and pulses — Determination of the nitrogen content and calculation of the crude protein content — Kjeldahl method*

ISO 21527-2, *Microbiology of food and animal feedstuffs — Horizontal method for the enumeration of yeasts and moulds — Part 2: Colony count technique in products with water activity less than or equal to 0.95*

3 Definitions

For the purposes of this standard the terms and definitions in ARS 465 and the following apply.

3.1

diluent

suitable, inert, edible food-grade carrier for micronutrients

3.2

premix

blend of fortificants and diluents formulated to provide specified and determinable amounts of micronutrients

3.3

fortified wheat flour

wheat flour to which nutrients have been added in accordance with this standard

3.4

fortificant

compound which contains the specified micronutrient intended to be added to a food

3.5

food fortification

practice of deliberately adding essential micronutrients in a food so as to improve the nutritional quality of the food and to provide a public health benefit with minimal risk to health

3.6

NaFeEDTA

Sodium iron Ethylenediamine tetraacetic acid

4 Quality requirements

4.1 Raw materials

Wheat grain from which the flour is obtained shall be of sound quality, free from sand, have characteristic odour and flavour conforming to ARS 465.

4.2 General requirements

4.2.1 Fortified wheat flour shall have the characteristic colour and shall be free from any objectionable flavours and odours.

4.2.2 The flour shall be free from insects, worms, fungal infestation, rodent contaminations and foreign matter.

4.2.3 The flour shall not contain flour from other cereals. However, the addition of malted barley flour not exceeding 1 % is permissible in the case of baker's flour.

4.3 Specific requirements

The types of wheat flour shall comply with the compositional requirements given in Table 1.

4.4 Self-raising flour

In addition to the specifications in Table 1, specific requirements for self-raising wheat flour may contain the following:

- a) edible salt conforming to ARS 471;
- b) acid ingredients which shall be one or any combination of the following:
 - i) sodium acid pyrophosphate;
 - ii) mono acid calcium phosphate;
 - iii) sodium aluminium phosphate; and
 - iv) sodium bicarbonate in sufficient amounts to provide not less than 0.4 % of available carbon dioxide.

Table 1 — Specific requirements

Parameter	Baker's flour	Home baking flour	Biscuit flour	Cracker flour	Self-raising flour	Standard flour	Atta flour	Whole meal flour	Method of test
Moisture content, % m/m, max	13	13	13	13	13	13	13	13	ISO 711 or ISO 712
Crude fibre content, % by mass, max.	1.0	1.0	1.0	1.0	1.0	1.5	2.0	2.0	ISO 5498
Total ash content, % by mass, max	0.7	0.7	0.55	0.70	2.0	1.10	2.0	2.0	ISO 2171
Residue on sieving through 180 micron sieve, % by mass, max.	0.8	0.8	0.5	0.5	0.8	30.0	55.0	30.0	AOAC 965.22
Protein content, % by mass, min.	11.0	9.0	8.0	8.0	8.0	11.0	12.0	12.0	ISO 20483

5 Fortification requirements

5.1 Levels of micronutrients

The wheat flour shall be fortified with all the micronutrients indicated using the fortificants shown, in such a way that the product conforms to the limits set in Table 2.

Factories should aim at fortifying the products at the recommended factory level to ensure the product conforms to the regulatory levels throughout the distribution chain.

5.2 Fortificants

Fortificant for use shall be stable compounds conforming to specifications in any of the following documents:

- a) British Pharmacopoeia (BP),
- b) Food Chemical Codex (FCC),
- c) Merck Index (MI),
- d) United States National Formulary (NF),

- e) European Pharmacopoeia (Ph. Eur),
- f) United States Pharmacopoeia (USP);
- g) FAO/WHO Codex Alimentarius Commission (CAC).

NOTE For the addition of iron, premix producers may either use NaFeEDTA at the levels provided, which should be tried first to test for compatibility with the flour and if low levels are needed, or the producer may use ferrous fumarate.

Table 2 — Requirements for levels of micronutrients in fortified wheat flour¹

Nutrient	Fortificant compound	Recommended factory level, mg/kg	Regulatory levels, mg/kg	
			Minimum	Maximum
Vitamin A	Vitamin A (Retinol) palmitate, spray-dried or equivalent, 0.075 % retinol, min.	1.0 ± 0.4	0.5	1.4
Vitamin B ₁	Thiamin Mononitrate, activity level, 81 %, min.	9.8 ± 4.4	4.6	NA ¹
Vitamin B ₂	Riboflavin, activity level, 100 %, min.	6.6 ± 3	3.3	NA ¹
Niacin	Niacinamide, activity level, 99 %, min.	60 ± 30	30	NA ¹
Vitamin B ₆	Pyridoxine, activity level, 82 %, min.	6.5 ± 3.5	3	NA ¹
Folate	Folic acid, activity level, 100 %, min.	2.3 ± 1	1.1	3.2
Vitamin B ₁₂	Vitamin B ₁₂ (water soluble), activity level, 0.1 %, min.	0.02 ± 0.009	0.01	NA ²
Zinc	Zinc oxide, activity level, 80 %, min.	60 ± 10	40	80
Total iron	Total iron	30 ± 10	20	NA ¹
Added iron	NaFeEDTA ² activity level, 13 % Fe, min.	30 ± 10	20	40
	Ferrous fumarate ² activity level, 32 %, min	40 ± 10	30	50

¹ NA — Not applicable. The maximum limits for these nutrients are not necessary because the upper tolerance limits of these nutrients are very high.

² The use of one of these would be considered.

5.3 Premix

The fortificants may be mixed with diluents or carrier as appropriate to form a premix. Diluents or carriers shall conform to USP, BP, Ph. Eur, NF, MI, FAO/WHO CAC or FFC.

The premix shall be made in such a way that at a given rate of addition to the product, the product shall conform to the requirements in Table 2. The premix may be formulated to conform to the provisions given in Table 3 or Table 4 when Fumarate or NaFeEDTA is used respectively.

Where the premix is made in accordance with Table 3, the addition rate shall be 500 g of premix per metric tonne of wheat flour. Where the premix is made in accordance with Table 4, the addition rate shall be 600 g of premix per metric tonne of wheat flour.

The premix shall be labelled with the addition rate (that is the amount of premix to be added to the wheat flour) in grams of premix per metric tonne of wheat flour and dilution factor.

NOTE This premix formulation in Table 3 and Table 4 is designed with minimum nutrient composition and does not take into consideration factory overages in the preparations of the premix.

Table 3 — Formulation of fortification mix for addition of vitamins and minerals to wheat flour if using ferrous fumarate as source of iron

Nutrient	Fortificant compound	Amount of micronutrient to be added to wheat flour, mg/kg	Amount of fortificant to be added to wheat flour, mg/kg	Amount of fortificant in premix, g/kg premix	Amount of nutrient in premix, g/kg premix
Vitamin A	Vitamin A (Retinyl) palmitate, spray-dried or equivalent, 0.075 % retinol, min.	1	13.3	26.7	2
Vitamin B ₁	Thiamin Mononitrate, activity level, 81 %, min.	9	11.1	22.2	18
Vitamin B ₂	Riboflavin, activity level, 100 %, min	6	6.0	12.0	12
Vitamin B ₃ (Niacin)	Niacinamide, activity level, 99 %, min	50	50.5	101.0	100
Vitamin B ₆	Pyridoxine, activity level, 82 %, min	6	7.3	14.6	12
Vitamin B ₉ (Folate)	Folic acid, activity level, 100 %, min	2	2.2	4.4	4
Vitamin B ₁₂	Vitamin B ₁₂ (Water soluble form), activity level, 0.1 %)	0.02	20.0	40.0	0.04
Iron	Ferrous fumarate, activity level, 32 % Fe, min.	40	125.0	250.0	80
Zinc	Zinc oxide, activity level, 80 %, min.	30	37.5	93.8	75
	Filling material (at least 25%)		68.2	317.5	
		TOTAL	341.2	1000	

Table 4 — Formulation of fortification mix for addition of vitamins and minerals to wheat flour if using NaFeEDTA as source of Iron

Nutrient	Fortificant compound	Amount of micronutrient to be added to wheat flour, mg/kg	Amount of fortificant to be added to wheat flour, mg/kg	Amount of fortificant in premix, g/kg premix	Amount of nutrient in premix, g/kg premix
Vitamin A	Vitamin A (Retinol) palmitate , spray-dried or equivalent, 0.075 % retinol, min.	1	13.3	26.7	2
Vitamin B ₁	Thiamin Mononitrate, activity level, 81 %, min.	9	11.1	22.2	18
Vitamin B ₂	Riboflavin, activity level, 100 %, min.	6	6.0	12.0	12
Vitamin B ₃ (Niacin)	Niacinamide, activity level, 99 %, min.	50	50.5	101.0	100
Vitamin B ₆	Pyridoxine, activity level, 82 %, min.	6	7.3	14.6	12
Vitamin B ₉ (Folate)	Folic acid, activity level, 100 %, min.	2	2.2	4.4	4
Vitamin B ₁₂	Vitamin B ₁₂ , (Water soluble form), activity level, 0.1 %, min.	0.02	20.0	40.0	0.04
Iron	NaFeEDTA, activity level,13 % Fe, min.	30	230.8	461.5	60
Zinc	Zinc oxide, activity level, 80 %, min.	30	37.5	93.8	75
	Diluent (Filling material, at least 25 %)		94.7	53.1	
		TOTAL	473.4	1000.0	

5.4 Stability of fortificants and premixes

The Vitamin fortificants and premixes shall have storage stability such that no more than 20 % of its original activity will be lost when stored for 21 days at 45 °C in a well closed container at a level 2.5g per kg in wheat flour having moisture content in the range of 13.5 % - 14.5 %.

The supplier of the premix shall provide the stability data for the fortificants and premixes.

6 Food additives

The product may contain food additives in accordance with CODEX STAN 192.

7 Hygiene

7.1 Fortified wheat flour shall be produced, prepared and handled in accordance with ARS 53.

7.2 The product shall be free from pathogenic micro-organism and shall conform to the microbiological limits in Table 5.

Table 5 — Microbiological limits for fortified wheat flour

S/N	Micro-organism(s)	Requirements	Method of test
1	Total plate count, cfu/g	10^3	ISO 4833
2	<i>Staphylococcus aureus</i> cfu/g max	10^2	ISO 6888
3	<i>Escherichia coli</i> , cfu/g, max.	absent	ISO 7251
4	<i>Salmonella</i> , per 25g, max.	absent	ISO 6579
5	<i>Coliforms</i> g (per 100 g)	absent	ISO 4832
6	Bacillus cereus, per 25g, max.	absent	ISO 7932
7	Yeasts and moulds, cfu/g, max.	10^3	ISO 21527-2
8	<i>Vibrio cholerae</i>	absent	ISO/TS 21872

8 Contaminants

8.1 Heavy metals

Fortified wheat flour shall conform to those maximum limits for heavy metals established by the Codex Alimentarius Commission for this commodity.

8.2 Pesticide residues

Fortified wheat flour shall conform to those maximum pesticide residue limits established by the Codex Alimentarius Commission for this commodity.

8.3 Mycotoxins

Fortified wheat flour shall conform to those maximum mycotoxin limits established by the Codex Alimentarius Commission for this commodity. In particular, aflatoxin levels in wheat flour for human consumption shall not exceed 10 µg/kg for total aflatoxins; and 5 µg/kg for aflatoxin B₁ when tested in accordance with ISO 16050.

9 Packaging

9.1 Fortified wheat flour shall be packed in suitable packages which shall be clean, sound, free from insects and fungal infestation, and the packing material shall be of food grade quality.

9.2 Fortified wheat flour shall be packed in containers which will safeguard the hygienic, nutritional, technological and organoleptic qualities of the products.

9.3 The containers, including packaging material, shall be made of materials which are safe and suitable for their intended use. They shall not impart any toxic substance or undesirable odour or flavour to the product.

9.4 Each package shall be securely closed and sealed.

NOTE 1 Packaging materials may be required to meet different regulations in the different destination countries.

NOTE 2 The packages fill should conform to the requirements of the legal metrology of the destination country.

10 Labelling

10.1 General labelling

In addition to the requirements in ARS 56, each package shall be legibly and indelibly marked with the following:

- i) product name as "fortified wheat flour"
- ii) name, address and physical location of the manufacturer/ packer/importer;
- iii) lot or batch number in code or in clear format;
- iv) brand name or registered trade mark, if any;
- v) net weight, in metric units;
- vi) the declaration "Human Food";
- vii) storage instruction as "Store in a cool dry place away from any contaminants";
- viii) date of manufacture;
- ix) best before date;
- x) instructions on disposal of used package;
- xi) country of origin;

Each product unit may also be marked with the national food fortification Logo, where the industry qualifies to use the mark.

10.2 Nutrition labelling

The names and the amount of the nutrients added in the fortified wheat flour shall be declared on the label in accordance with CAC/GL 2.

10.3 Nutrition and health claims

Fortified wheat flour may have claims on the importance of the added nutrients in nutrition and health. Such claims when declared shall be consistent with CAC/GL 1 and CAC/GL 23.

11 Methods of sampling

Sampling shall be done in accordance with ISO 13690.

12 Methods of test

Testing for micronutrients may be conducted using any internationally recognized test methods

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